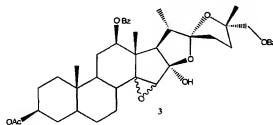


What is claimed is:

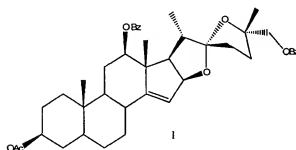
1. A method of oxidizing a hydrocarbon comprising reacting the hydrocarbon in an anhydrous solvent with a chromium [VI] oxidant and a co-oxidant at a reaction temperature of between about -50°C to about 0°C, thereby catalytically and chemospecifically oxidizing the hydrocarbon: (i) substantially stereospecifically at a tertiary carbon to form a tertiary alcohol or hemiacetal, or (ii) at a one or more secondary carbons to form a ketone or dione, or (iii) at cis tertiary CH groups to form a ring-cleaved dione.
2. The method of claim 1, wherein (i) the chromium [VI] oxidant is selected from the group consisting of  $\text{CrO}_3$ , chromoyl diacetate, chromoyl chloride, chromoyl bistrifluoroacetate, chromoyl bistriflate, and chromoyl bis t-butylester, (ii) the co-oxidant is selected from the group consisting of periodic acid, tetrabutylammonium periodate, hydrogen peroxide, t-butyl hydroperoxide, diacyl peroxides, TMSOOTMS, peroxydisulfate and persulfate, and (iii) the solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures, thereof.
3. The method of claim 2, wherein the chromium [VI] oxidant is chromoyl diacetate, the co-oxidant is periodic acid or tetrabutylammonium periodate, the solvent is a mixture of acetonitrile and methylene chloride, the reaction time is from about thirty minutes to about three hours, and the reaction takes place under a positive pressure of inert gas.
4. The method of claim 2, wherein a mixture solution of the hydrocarbon, chromium [VI] oxidant and an aqueous solvent is formed and a mixture of co-oxidant and aqueous solvent is added to the mixture solution.
5. The method of claim 4, wherein the mixture solution of hydrocarbon, chromium [VI] oxidant and anhydrous solvent comprises  $\text{CrO}_3$ , methylene chloride and acetonitrile and the mixture of co-oxidant and an anhydrous solvent comprises periodic acid and acetonitrile.
6. The method of claim 4, wherein the mixture solution of hydrocarbon, chromium [VI] oxidant and anhydrous solvent comprises chromoyl diacetate, methylene chloride and

acetonitrile and the mixture of co-oxidant and anhydrous solvent comprises tetrabutylammonium periodate and acetonitrile.

7. The method of claims 5 and 6, wherein the reaction temperature is approximately -50°C to approximately -20°C.
8. The method of claim 7, wherein the reaction temperature is approximately -40° C.
9. The method of claims 1 and 2, wherein the hydrocarbon is a saturated or unsaturated, substituted or unsubstituted, hetero or non-hetero, aromatic or nonaromatic linear, branched or mono, bi- or polycyclic compound.
10. The method of claim 9, wherein said hydrocarbon contains a hydrocarbon tertiary carbon or two cis tertiary carbons and said tertiary carbon is oxidized to form a tertiary alcohol or hemiacetal and said two cis tertiary carbons are oxidized to form a ring-cleaved dione.
11. The method of claim 9, wherein a hydrocarbon secondary carbon is oxidized to form a ketone.
12. The method of claim 9, wherein the hydrocarbon contains one or more of the following groups: alkyl, cycloalkyl, alkenyl, alkynyl, alkoxy, allenyl, aryl, aralkyl, aralkylene, alkarylene, an epoxide, heteroaryl, haloalkyl, haloalkenyl and haloalkynyl.
13. The method of claim 11, wherein the hydrocarbon secondary carbon is contained with an alkoxy group or is a benzylic carbon.
14. A method of making a compound comprising an epoxyalcohol of formula 3:



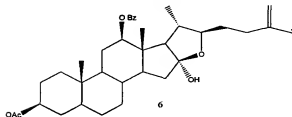
comprising reacting a compound comprising a spiroketal of formula 1



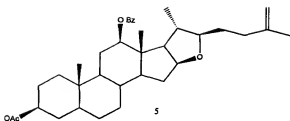
in an anhydrous solvent with a chromium [VI] oxidant and a co-oxidant at a reaction temperature of between about -100°C to about 0°C and a reaction time of between about thirty minutes to about three hours.

15. The method of claim 14, wherein: (i) the chromium [VI] oxidant is selected from the group consisting of  $\text{CrO}_3$ , chromoyl diacetate, chromoyl chloride, chromoyl bistrifluoroacetate, chromoyl bistriflate, and chromoyl bis t-butylester, (ii) the co-oxidant is selected from the group consisting of periodic acid, tetrabutylammonium periodate, hydrogen peroxide, t-butyl hydroperoxide, diacyl peroxides,  $\text{TMSOOTMS}$ , peroxydisulfate and persulfate, (iii) the anhydrous solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures thereof, and (iv) the reaction temperature is between about -60°C to about -20°C.

16. A method of making a compound comprising a hemiacetal of formula 6:



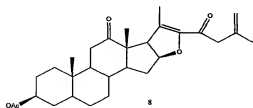
comprising reacting a compound comprising a ketone of formula 5:



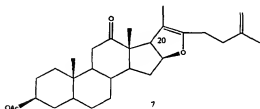
in an anhydrous solvent with a chromium [VI] oxidant and a co-oxidant at a reaction temperature of between about  $-100^{\circ}\text{C}$  to about  $0^{\circ}\text{C}$  and a reaction time of about thirty minutes to about three hours .

17. The method of claim 16, wherein: (i) the chromium [VI] oxidant is selected from the group consisting of  $\text{CrO}_3$  , chromoyl diacetate, chromoyl chloride, chromoyl bistrifluoroacetate, chromoyl bistriflate, and chromoyl bis t-butylester, (ii) the co-oxidant is selected from the group consisting of periodic acid, tetrabutylammonium periodate, hydrogen peroxide, t-butyl hydroperoxide, diacyl peroxides, TMSOOTMS, peroxydisulfate and persulfate, (iii) the anhydrous solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures thereof, and (iv) the reaction temperature is between about  $-60^{\circ}\text{C}$  to about  $-20^{\circ}\text{C}$ .

18. A method of making a compound comprising an  $\alpha$ ,  $\beta$ -unsaturated ketone of formula 8:



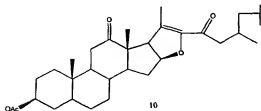
comprising reacting a compound comprising an enol ether of formula 7



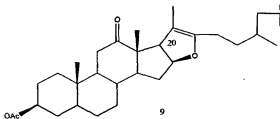
in an anhydrous solvent with a chromium [VI] oxidant and a co-oxidant at a reaction temperature of between about -100°C to about 0°C and a reaction time of from about thirty minutes to about three hours.

19. The method of claim 18, wherein: (i) the chromium [VI] oxidant is selected from the group consisting of  $\text{CrO}_3$ , chromoyl diacetate, chromoyl chloride, chromoyl bistrifluoroacetate, chromoyl bistriflate, and chromoyl bis t-butylester, (ii) the co-oxidant is selected from the group consisting of periodic acid, tetrabutylammonium periodate, hydrogen peroxide, t-butyl hydroperoxide, diacyl peroxides,  $\text{TMSOOTMS}$ , peroxydisulfate and persulfate, (iii) the anhydrous solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures thereof, and (iv) the reaction temperature is between about -60°C to about -20°C.

20. A method of making a compound comprising an  $\alpha$ ,  $\beta$ -unsaturated ketone of formula 10:



comprising reacting a compound comprising an enol ether of formula 9



in an anhydrous solvent with a chromium [VI] oxidant and a co-oxidant at a reaction temperature of between about -100°C to about 0°C and a reaction time of from about thirty minutes to about three hours.

21. The method of claim 20, wherein : (i) the chromium [VI] oxidant is selected from the group consisting of  $\text{CrO}_3$ , chromoyl diacetate, chromoyl chloride, chromoyl

bistrifluoroacetate, chromoyl bistriflate, and chromoyl bis t-butylester, (ii) the co-oxidant is selected from the group consisting of periodic acid, tetrabutylammonium periodate, hydrogen peroxide, t-butyl hydroperoxide, diacyl peroxides, TMSOOTMS, peroxydisulfate and persulfate, (iii) the anhydrous solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures thereof, and (iv) the reaction temperature is between about -60°C to about -20°C.

22. A method of oxidizing a hydrocarbon comprising reacting the hydrocarbon in an anhydrous solvent with a  $\text{CrO}_3$  or chromoyl diacetate oxidant and a periodic acid or tetrabutylammonium periodate co-oxidant at a reaction temperature of between about -60°C to about -20°C, thereby catalytically and chemospecifically oxidizing the hydrocarbon: (i) substantially stereospecifically at a tertiary C-H bond to form a tertiary alcohol or hemiacetal, (ii) at a one or more secondary carbons to form a ketone or dione, or (iii) at cis tertiary C-H groups to form a ring-cleaved dione.

23. The method of claim 22, wherein the hydrocarbon is allylically oxidized at a tertiary C-H bond to form a hemiacetal at the tertiary carbon.

24. The method of claim 22, wherein the hydrocarbon is allylically oxidized at one or more secondary C-H bonds to form a ketone at the secondary carbon.

25. The method of claims 23 or 24, wherein the tertiary or secondary C-H bond is  $\alpha$  to an alkoxy group.

26. The method of claims 23 or 24, wherein the hydrocarbon is a 5/5 spiroketal.

27. A method of oxidizing a hydrocarbon tertiary C-H bond which is  $\alpha$  to an alkene comprising: reacting the hydrocarbon in an anhydrous solvent with a  $\text{CrO}_3$  or chromoyl diacetate oxidant and a periodic acid or tetrabutylammonium periodate co-oxidant at a reaction temperature of between about -60°C to about -20°C, for a reaction time of about thirty minutes to about two hours, and under a positive pressure of an inert gas, thereby

inserting an oxygen at the tertiary carbon to form either a hemiacetal or alcohol without epoxidation of the alkene.

28. The method of claim 27, wherein the anhydrous solvent is selected from the group consisting of acetic acid, acetonitrile, methylene chloride and mixtures thereof, and the reaction temperature is about  $-40^{\circ}\text{C}$ .

29. The method of claim 28, wherein the hydrocarbon comprises a spiroketal which is oxidized to form an epoxyalcohol.

30. The method of claims 28 or 29, wherein the chromium [VI] oxidant is  $\text{CrO}_3$  and the co-oxidant is periodic acid.

31. The method of claim 22, wherein a benzylic C-H bond is oxidized to form a ketone.